

What is claimed is:

1. An apparatus for reducing orbital motion during Czochralski crystal growth in a crystal pulling machine comprising:
 - a bottom chamber;
 - a crucible within the bottom chamber, the crucible rotatable around an axial axis and containing a molten material;
 - a top chamber above the bottom chamber;
 - a winding drum mounted on the top chamber, the winding drum rotatable around the axial axis;
 - a flexible member wound around the winding drum and extending downward along the axial axis into the pull chambers; the flexible member supporting and pulling a crystal from the molten material;
 - a sensor to detect orbital motion; and
 - at least one flow nozzle for directing a purge gas onto at least one of the flexible member and the crystal.
2. The apparatus of Claim 1, wherein the sensor to detect orbital motion is a diameter measurement device.
3. The apparatus of Claim 2, wherein the diameter measurement device includes at least one CCD camera.

4. The apparatus of Claim 2, wherein the diameter measurement device includes a laser.
5. The apparatus of Claim 1, wherein the sensor to detect orbital motion is a proximity sensor.
6. The apparatus of Claim 1, wherein the flexible member is a wire.
7. The apparatus of Claim 1, wherein the flexible member is a cable.
8. The apparatus of Claim 1, wherein the at least one flow nozzle directs the purge gas radially inward toward the axial axis.
9. The apparatus of Claim 8, wherein the flow nozzle directs the purge gas radially inward toward, and perpendicular to, the axial axis.
10. The apparatus of Claim 8, wherein the flow nozzle directs the purge gas radially inward toward the axial axis at an oblique angle to the axial axis.
11. An apparatus for reducing orbital motion during Czochralski crystal growth in a crystal pulling machine comprising:
 - a bottom chamber;
 - a crucible within the bottom chamber, the crucible rotatable around an axial axis and containing a molten material;
 - a top chamber above the bottom chamber;

a winding drum mounted on the top chamber, the winding drum rotatable around the axial axis;

a flexible member wound around the winding drum and extending downward along the axial axis into the pull chambers; the flexible member supporting and pulling a crystal from the molten material;

a diameter measurement system to measure the diameter of the crystal and to detect orbit; and

at least one flow nozzle for directing a purge gas onto the crystal.

12. The apparatus of Claim 11, wherein the diameter measurement system includes a controller for controlling flow of the purge gas to the at least one flow nozzle.

13. The apparatus of Claim 12, wherein the controller operates at least one mass flow controller to control the volume of purge gas supplied to the at least one flow nozzle.

14. The apparatus of Claim 12, wherein controller operates at least one control valve to open and close flow of the purge gas to each of the at least one flow nozzle.

15. The apparatus of Claim 12, wherein purge gas is supplied to the at least one flow nozzle only when an orbiting crystal is in a perigee interval position to a flow nozzle.

16. The apparatus of Claim 11, wherein a plurality of flow nozzles radially surround the crystal.
17. The apparatus of Claim 11, wherein a plurality of flow nozzles are spaced vertically in the pulling machine.
18. The apparatus of Claim 11, wherein the at least one flow nozzle directs the purge gas radially inward toward the axial axis.
19. The apparatus of Claim 18, wherein the flow nozzle directs the purge gas in a flow perpendicular to the axial axis.
20. The apparatus of Claim 18, wherein the flow nozzle directs the purge gas in a flow at an oblique angle to the axial axis.
21. The apparatus of Claim 11, wherein the diameter measurement system includes a CCD camera.
22. The apparatus of Claim 11, wherein the diameter measurement system includes a laser.
23. An apparatus for reducing orbital motion during Czochralski crystal growth in a crystal pulling machine comprising:
a bottom chamber;

a crucible within the bottom chamber, the crucible rotatable around an axial axis and containing a molten material;

a top chamber above the bottom chamber;

a winding drum mounted on the top chamber, the winding drum rotatable around the axial axis;

a flexible member wound around the winding drum and extending downward along the axial axis into the pull chambers; the flexible member supporting and pulling a crystal from the molten material;

a sensor to detect orbital motion;

a purge gas inlet in the top chamber for directing a purge gas downward through the pulling machine; and

at least one flow nozzle for directing a purge gas onto the crystal.

24. The apparatus of Claim 23, wherein the sensor to detect orbital motion includes a controller for controlling flow of the purge gas to the at least one flow nozzle.
25. The apparatus of Claim 24, wherein the controller operates at least one mass flow controller to control the volume of purge gas supplied to the at least one flow nozzle.
26. The apparatus of Claim 24, wherein controller operates at least one control valve to open and close flow of the purge gas to each of the at least one flow nozzle.

27. The apparatus of Claim 24, wherein purge gas is supplied to the at least one flow nozzle only when an orbiting crystal is in a perigree interval position to a flow nozzle.
28. The apparatus of Claim 23, wherein a plurality of flow nozzles radially surround the axial axis and direct flow toward the axial axis.
29. The apparatus of Claim 23, wherein a plurality of flow nozzles are spaced vertically in the crystal pulling machine.
30. The apparatus of Claim 23, wherein the at least one flow nozzle directs the purge gas radially inward toward the axial axis.
31. The apparatus of Claim 30, wherein the flow nozzle directs the purge gas radially inward toward the axial axis in a flow perpendicular to the axial axis.
32. The apparatus of Claim 30, wherein the at least one flow nozzle directs the purge gas radially inward toward the axial axis at an oblique angle to the axial axis.
33. The apparatus of Claim 23, wherein the sensor to detect orbital motion includes a CCD camera.
34. The apparatus of Claim 23, wherein the sensor to detect orbital motion includes a laser.

35. The apparatus of Claim 23, wherein the sensor to detect orbital motion is a proximity sensor.

36. The apparatus of Claim 23, wherein the flexible member is a wire.

37. The apparatus of Claim 23, wherein the flexible member is a cable.